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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/296,835	04/22/99	WEIMER R	07653/025001

EXAMINER	
KIELIN, E	
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DATE MAILED: 08/28/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.	Applicant(s)
09/296,835	Weimer et al.
Examiner	**Art Unit**
Erik Kielin	2813

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on *Aug 8, 2001* .

2a) ☐ This action is **FINAL.** 2b) ☒ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) *2-6, 8, and 10-12* is/are pending in the application.

4a) Of the above, claim(s) _____ is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) *2-6, 8, and 10-12* is/are rejected.

7) ☐ Claim(s) _____ is/are objected to.

8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

9) ☐ The specification is objected to by the Examiner.

10) ☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved.

12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

a) ☐ All b) ☐ Some* c) ☐ None of:

1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

*See the attached detailed Office action for a list of the certified copies not received.

14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

15) ☒ Notice of References Cited (PTO-892)
16) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
17) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s). _____
18) ☐ Interview Summary (PTO-413) Paper No(s). _____
19) ☐ Notice of Informal Patent Application (PTO-152)
20) ☐ Other:

DETAILED ACTION

Continued Prosecution Application

1. The request filed on 8/8/01for a Continued Prosecution Application (CPA) under 37 CFR 1.53(d) based on parent Application No. 09/296,835 is acceptable and a CPA has been established. An action on the CPA follows.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims **8**, 2-4, 10-12 are rejected under 35 U.S.C. 102(b) as being anticipated by **Patel** et al. (US 5,374,578) in view of either of **Emesh** et al. (US 5,728,603) and **Chivukula** et al. (US 6,066,581).

Patel discloses forming an oxygen deficient ferroelectric film 14 (Figs. 2-6) such as PZT which inherently has a dielectric constant of greater than 25; annealing in ozone using RTA (which must necessarily occur, then, in an RTA chamber) at a temperature range of 650-850°C

for about 5-30 seconds (in one example) in order to increase the oxygen content of the ferroelectric film (column 2, lines 30-33); performing a stabilizing treatment using oxygen either before or after the ozone anneal (column 4, lines 23-29).

Patel does not teach using wet oxidation.

Emesh teaches forming an oxygen deficient ferroelectric material such as PZT; subjecting the dielectric film to a wet oxidation using a mixture comprising water and ozone in a rapid thermal annealing (RTA) chamber in order to reduce the temperature at which the ferroelectric material densifies/crystallizes and also to reduce the stress in the ferroelectric film and improves its the electrical properties (column 5, lines 50-67) which also inherently increases the oxygen content of the film as indicated by reduced leakage current (sentence bridging columns 3-4).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate water during the ozone anneal of **Patel** for the reasons indicated in **Emesh** which includes at least to reducing the stress in the ferroelectric film and improving its the electrical properties (column 5, lines 50-67).

Regarding the dielectric constant of various ferroelectric materials, see **Emesh**, column 8, Table I.

Similarly, **Chivukula** teaches forming an oxygen deficient ferroelectric material such as PZT; subjecting the dielectric film to a wet oxidation using a mixture comprising water and ozone at a temperature of 450-650°C in a rapid thermal annealing (RTA) chamber for 30 seconds to several minutes to form uniform grain sizes in the ferroelectric material in a shorter time, at

reduced temperature and superior characteristics during high frequency use compared to using dry oxidation (column 14, lines 27-48). (See also column 13, lines 30-53.)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate water during the ozone anneal of **Patel** for the reasons indicated in **Chivukula**, as noted.

Regarding claims 2-4, although **Patel** does not recite Applicant's exact ranges of either 450-750°C or 750-900°C or exact times of 20-60 seconds for the oxidation, **Patel** does disclose an overlapping temperature range of 650-850 and time range of 5-30 seconds, in at least one example. **Emesh** teaches 300 seconds which is a function of the lower temperatures used. **Chivukula** teaches 30 seconds to several minutes which is again temperature and material dependent. These claims are *prima facie* obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. *In re Woodruff*, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also *In re Aller*, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art general conditions is obvious). It would have been obvious to one of ordinary skill in the art at the time the invention was made to optimize the temperature and anneal time to provide the best ferroelectric film, according to the precedent above. Also note, although **Emesh** teaches an ozone/water oxidizing temperature of 500°C or less, Emesh also teaches that increasing the temperature at which the wet oxidation occurs increases the dielectric constant of the high dielectric constant film (column 8, lines 6-12) which is desired in the semiconductor device fabrication art especially for fabricating capacitors for DRAM devices.

Regarding claim 11, **Patel** does not teach performed the ozone oxidizing or the oxygen stabilizing treatments at different temperatures, each of **Emesh** and **Chivukula** teaches that the addition of water vapor reduces the densification/crystallization temperature from dry conditions. It would have been obvious to one of ordinary skill in the art at the time the invention was made to perform the wet ozone anneal of **Patel** at a lower temperature than the oxygen stabilizing anneal because each of **Emesh** and **Chivukula** teaches a lower temperature may be used for wet versus dry oxidation.

4. Claims 5-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Patel** in view of either of **Emesh** and **Chivukula** as applied to claims **8**, 2-4, 10-12 above, and further in view of the excerpt from **Van Zant**, (Microchip Fabrication, A Practical Guide to Semiconductor Processing, 3rd ed. McGraw-Hill: New York, 1997, pp. 157-160).

The prior art as explained above discloses all of the limitations of the claims except for using a mixture of hydrogen and oxygen to form the wet oxidation gas mixture, instead **Emesh** and **Chivukula** teach using a bubbler.

Van Zant teaches that "Dryox," a mixture of hydrogen and oxygen which react to form a steam oxidizing mixture in the reactor is preferred over liquid systems such as a bubbler because the process is cleaner and more controllable and also that "Dryox is the preferred method for production of advanced devices." (See pp. 157-160 -- especially page 160.) It would have been obvious to one of ordinary skill in the art at the time the invention was made to use hydrogen and oxygen to form the wet oxidation mixture for the reasons indicated in **Van Zant**, as noted.

Then the only difference is that the claimed ratios of hydrogen to oxygen gases is not taught. It has been held that selection of optimum ranges within prior art general conditions is *prima facie* obvious in the absence of unexpected results. It would have been obvious to one of ordinary skill in the art at the time the invention was made to optimize the hydrogen to oxygen gases to perform the taught wet oxidation process for forming the best ferroelectric film, according to precedent, *supra*.

Response to Arguments

5. Applicant's arguments filed 8/8/01 are moot in view of new grounds of rejection.

Conclusion

Any inquiry concerning this communication from examiner should be directed to Erik Kielin whose telephone number is (703) 306-5980 and e-mail address is erik.kielin@uspto.gov. The examiner can normally be reached by telephone on Monday through Thursday 9:00 AM until 7:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Charles Bowers, can be reached at (703) 308-2417 or by e-mail at charles.bowers@uspto.gov. The fax phone number for the group is (703) 308-7722 or -7724.

EK

August 23, 2001

Charles Bowers
Supervisory Patent Examiner
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